

Geologie, und Paläontologie." The two chemical numbers treat with all the fullness and thoroughness characteristic of this estimable work "Dichte," "Didym," "Diffusion," "Dinte," "Diphenylverbindungen," "Dissociation," "Dünger," and "Eisen," and the accompanying woodcuts illustrating any difficult experiments in the text add materially to the practical value of the articles. The new number, finally, of the Mineralogical, Geological, and Palæontological Dictionary contains important contributions on "Reptilien" and "Rhizopoden," by Rolle; on "Salze," by Kennigott; on "Schichtenlehre" and "Schwankungen im Niveau vom Meer und Festlande," by von Lasaulx—articles distinguished not more by fullness and compactness of matter than by clearness of diction.

WITH unflagging vigour and learning the new Italian quarterly, *La Nuova Scienza*, prosecutes the mission it has undertaken of building up an exact philosophy on the foundation of the natural and historical sciences. In the last number for June, 1885, the articles of chief interest, all contributed by the indefatigable editor, Prof. Enrico Caporali, are: Modern Italian thought, German anticlerical evolution, and the Pithagoric formula in cosmical evolution. The last-mentioned paper deals with the evolution of gravitation, of heat, of electricity, chemical affinity, lower organic force, higher organic force, sentient force, social authority; fatalist and free evolution. It is held in general that all evolution is due more to internal energy than to outward conditions, in opposition to Herbert Spencer's theory of mechanical causes.

THE address of Mr. W. H. Dall, vice-president to the Anthropological Section of the American Association for the Advancement of Science at Ann Arbor, last month, has been printed as a separate pamphlet. The subject of the address was "The Native Tribes of Alaska."

THE additions to the Zoological Society's Gardens during the past week include a Macaque Monkey (*Macacus cynomolgus* ♂) from India, presented by Mr. A. Cornet; a Red Kangaroo (*Macropus rufus* ♀) from Australia, presented by Mr. G. Wylie; a Bonelli's Eagle (*Nisaetus fasciatus*) from North Africa, presented by Capt. W. R. Taylor, s.s. *Empusa*; two Tawny Owls (*Syrnium aluco*), European, presented by Mr. H. Lee; a Nightjar (*Caprimulgus europæus*), European, presented by Mr. Cuthbert Johnson; a Robben Island Snake (*Coronella phocærum*) from South Africa, presented by the Rev. G. H. R. Fisk, C.M.Z.S.; seven Blue-bearded Jays (*Cyanocorax cyanopogon*) from Para, purchased; a Beisa Antelope (*Oryx beisa* ♀), born in the Gardens.

ASTRONOMICAL PHENOMENA FOR THE WEEK, 1885, SEPTEMBER 27 TO OCTOBER 3

(For the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on Sept. 27

Sun rises, 5h. 56m.; souths, 11h. 50m. 51' 3s.; sets, 17h. 46m.; decl. on meridian, 1° 48' S.; Sidereal Time at Sunset, 18h. 13m.

Moon (three days after Full) rises, 19h. 0m.*; souths, 2h. 1m.; sets, 9h. 13m.; decl. on meridian, 10° 42' N.

Planet	Rises h. m.	Souths h. m.	Sets h. m.	Decl. on meridian
Mercury ...	4 29 ...	11 1 ...	17 33 ...	5 36 N.
Venus ...	9 34 ...	14 12 ...	18 50 ...	16 17 S.
Mars ...	0 19 ...	8 11 ...	16 3 ...	19 47 N.
Jupiter ...	4 33 ...	11 1 ...	17 29 ...	4 46 N.
Saturn ...	22 1 ...	6 9 ...	14 17 ...	22 19 N.

* Indicates that the rising is that of the preceding day.

Occultations of Stars by the Moon

Sept.	Star	Mag.	Disap.	Reap.	Corresponding angles from ver- tex to right for inverted image
			h. m.	h. m.	o o
28 ...	48 Tauri ...	6 ...	21 56 ...	22 45 ...	33 273
28 ...	γ Tauri ...	4 ...	23 46 ...	0 43† ...	36 279
29 ...	75 Tauri ...	6 ...	4 41 ...	5 41 ...	149 268
29 ...	θ ¹ Tauri ...	4½ ...	4 48 ...	5 26 ...	54 1
29 ...	B.A.C. 1391 ...	5 ...	5 41 ...	6 51 ...	109 324
30 ...	111 Tauri ...	5½ ...	3 2 ...	4 17 ...	73 268
30 ...	117 Tauri ...	6 ...	5 15 ...	6 5 ...	53 341
Oct.					
2 ...	λ Geminorum ...	3½ ...	0 38 ...	1 32 ...	30 248

† Occurs on the following day.

The Occultations of Stars are such as are visible at Greenwich.

Sept.	h.	
27 ...	9 ...	Mercury in conjunction with and 0° 52 north of Jupiter.
Oct.		
1 ...	11 ...	Saturn in conjunction with and 4° 15' north of the Moon.
3 ...	19 ...	Mars in conjunction with and 5° 4' north of the Moon.

THE ASTRONOMICAL ASSOCIATION

THE Astronomical Association held their eleventh general meeting this year at Geneva from Aug. 19 to 22 inclusive, and the representatives of so many nations were present that the meeting fully bore out the character of an international one. Among the fifty members, or thereabouts, attending were: Struve, from Pulkowa; Newcomb, from Washington; Christie, from Greenwich; Dunér, from Lund; Pechule, from Copenhagen; Tietjen, from Berlin; Krüger, from Kiel; Schur, from Strassburg; Tisserand, from Paris; Spörer, from Potsdam. The office-bearers were: Auwers, from Berlin, President; Schönfeld, from Bonn, and Seeliger, from Munich, Secretaries; Bruns, from Leipzig, Treasurer; while Bakhuyzen, from Leiden, Gylden, from Stockholm, and Weiss, from Vienna, were honorary members of the Committee. Prof. Oppolzer, who was also a member of the Committee, was unable to attend.

The first sitting was opened by President Auwers in the aula of the University at 10 in the forenoon of the 19th. Among the scientific reports of the Committee the full communications of Prof. Weiss on the present state of the computations of the orbits of the comets were of special interest. Of the 12 periodical comets returned at different times to their perihelion, 8 had again been regularly determined by the same calculators. Of the remaining four three were removed from our present care: Biela's, which, as was known, had been lost to observation, and the comets of Halley and Pons-Brooks, whose next perihelion lay too remote in the future. There was, consequently, but one periodical comet—Brorsen's—to be taken account of. As to the remaining non-returning comets, of the 168 which had appeared in this century 41 were to be regarded as settled, 23 had their orbits pretty well determined; in the case of 58 comets a new calculation of the orbit was desirable for various reasons, and in all 46 had yet to be calculated definitely. There was, therefore, a wide field of labour open. Prof. Weiss accordingly sought to commend to the Society the establishment of a common calculation bureau for the settlement of the questions at issue, while the exact detailed treatment of a particular comet should in future, as hitherto, be left to the initiative of a single calculator. In the discussion following this address, Staatsrath Struve argued against the founding of such a bureau on the ground that the comets were of too peculiar a nature to accommodate themselves to the methodic treatment of a calculation bureau. No resolution was taken on the question.

This report was followed by communications of a business character on the great zone undertaking of the Society. These communications were of no great extent, the undertaking being already in near prospect of completion. The photometric survey of the heavens by Prof. Pickering, of Harvard College, read by Prof. Auwers, was heard with special interest.

Next followed the scientific addresses. Dr. Schram, Observer

in the Austrian Triangulation, communicated a table calculated by him, which would shortly be published, a table which materially lightened the approximate calculation of an eclipse for a particular spot on the surface, according to Oppolzer's elements.

Prof. Weiss then communicated the publication of the second volume of the *Annals* of the Vienna Observatory, and followed this up with the remark that the meridian circle, which was sixty years old, was now very much in need of repair; but, unfortunately, there was no money at disposal for this purpose.

After the President had opened the second sitting at ten o'clock on August 20, he communicated a report on the photographic mapping of all the stars of the "Bonner-Durchmusterung" which Gill (of the Cape Observatory) had begun, and of which about 100 plates were already to hand. The time taken for the exposure of each plate amounted on an average to one hour.

After various deliberations of a more private character the discussion turned on Resolution VI. of the Meridian Conference of Washington. The President declared emphatically that the question could be considered in this assembly only from an astronomical standpoint. The question was simply whether it were desirable for the astronomer to transfer the beginning of the day to midnight, and to this question the discussion should be restricted. At the outset the President announced that the Committee of the Society, with the exception of one member not present (Oppolzer)—that is, in the proportion of seven to one—had voted against the adoption of the proposal.

Staatsrath Struve (from Pulkowa) at once opposed the restriction advanced by the President, which, he thought, involved a one-sided treatment of the matter. It was to their advantage, he asserted, not to seclude themselves from the rest of the world. Magnetic and meteorological observers, he said, counted their day from midnight. Many astronomers, moreover, he continued, worked by day, and most observations were made between six and twelve in the evening. The change was defended by men eminent in science. The reform assuredly met a deeply-felt want. The question was "Should they make this sacrifice or not?"

Prof. Spörer, of Potsdam, mentioned that he always counted his observations from midnight.

Prof. Newcomb, of Washington, spoke at considerable length on the question, and rather against than in favour of the adoption of the proposal of universal time.

Prof. Weiss, of Vienna, was of opinion that the sacrifices demanded of astronomers by this reform were too great, and that the advantages were more than counterbalanced by the disadvantages. He laid stress on the fact that astronomers were wont to make their calculation of time from the moment when the time-determining object—the spring point—the mean sun—passed the meridian. That was also the true point of commencement. The observations which were of interest to the public at large, might be given in universal time, whereas with their more esoteric observations they might adhere to the old reckoning. The astronomer should keep by himself, and pay no attention to claims of intercourse.

Prof. Šafárik, of Prague, said, "Why should we make a sacrifice on behalf of the public that feels no concern with our labours?"

Prof. Krüger, of Kiel, thought that altogether there were but few necessary points of relation between the astronomer and the public—points, however, which could be readily taken account of if the public desired it.

Dr. Dunér, from Lund, argued that by a change of date it would be impossible not to make a sudden break in astronomical labours that had hitherto been carried on uninterruptedly, to whatever time of day or night the commencement of the day was transferred. He concluded by expressing his opinion that the sacrifices demanded were too great.

Geheimrath Auwers expressed himself as personally opposed to the change, principally in order to avoid a discontinuity in the calculation of time which might, later on especially, lead to sensible errors.

Prof. Bakhuyzen, of Leiden, was refused a hearing, because he wanted to speak of seamen, who have the reform specially at heart.

Staatsrath Struve remonstrated against this proceeding, and argued that the question ought not to be treated onesidedly. At the Washington Conference seamen had the majority of representation, and opinion had there been almost unanimously

expressed in favour of the reform. He was swayed by the desire of rendering astronomy useful to the rest of the world.

Prof. Gylden, of Stockholm, argued that the change must give rise to vexatious errors unless it were universally carried out on one line. As the realisation of this idea was, however, more than could be looked for at present, he would now have to vote against the universal time. He believed, nevertheless, that in twenty or thirty years hence the majority of astronomers would be in favour of the universal time.

Prof. Tietjen, of Berlin, thought that in the Berlin Year-Book at all events, no such change would find place before 1900.

Staatsrath Struve maintained that in the Royal Astronomical Society the majority were in favour of the universal time.

Dr. Pechule, of Copenhagen, was also of opinion that it would be well for astronomy to accommodate itself to the rest of the world; but only when all were of one mind should the innovation be simultaneously and universally introduced.

Prof. Folie, of Brussels, thought that in all reforms there were some stragglers, and in his opinion it was the duty of astronomers energetically to take the initiative in the good cause.

After some recapitulatory observations of the President the discussion closed. No resolution whatever was passed on the subject.

It may be worth while mentioning here in respect of this subject that in the reading of the protocol it was affirmed that all the members of the Committee who were present were opposed to the adoption of the universal time. Objecting to this declaration, Dr. Pechule stated that Prof. Gylden had only voted against the *immediate* adoption, while he entirely approved the *principle* of the proposed reform. The protocol had accordingly to be altered so as to give effect to this statement.

The series of scientific addresses was resumed by Dr. Mittag-Leffler, from Stockholm, who communicated the mathematical prize exercises which, under the auspices of King Oscar II., had been instituted by a special Commission.

Staatsrath Struve handed, for circulation, photographs of the great refractor of 30 inches aperture, which a short time ago had been mounted in Pulkowa, and expressed his complete satisfaction with the result.

Prof. Newcomb had thoroughly studied the instrument for seven days continuously, and corroborated Staatsrath Struve's views regarding the value of the instrument, entering into various details on the matter.

Prof. Tisserand, of Paris, spoke of a purely theoretical examination of the rotation of the earth.

Dr. Steinheil spoke on the calculations of Galileo's telescopes of new construction.

Prof. Spörer, of Potsdam, gave a somewhat long address on the new views regarding the physics of the sun.

The following day was devoted to a common trip around the Lake of Geneva, Col. Emile Gautier, at present Director of the Geneva Observatory, engaging at his own cost the saloon steamship *Winkelried* for this purpose. The dinner, which was served on board ship, gave opportunity for expressing the warmly-felt thanks of so many guests to their generous host for the entertainment he had provided them during the continuance of the Congress.

On the last day of the meeting, Saturday, August 22, the proceedings of a business character were brought to a close. The statutory order respecting the raising of the fee for life-membership to 185 marks was adopted. As the place of meeting for 1887, Kiel was fixed on. The new election of a committee made no change in its former composition.

The scientific addresses were opened by Prof. Gylden, who spoke of a graphic representation of planetary orbits.

Prof. Newcomb followed with an address on perturbations and their numerical calculation.

Prof. Bakhuyzen made communications respecting his treatment of Schröter's observations of Mars. He came to the conclusion that since Schröter's time "Huggin's Inlet" had probably changed considerably, whereby the hypothesis that Mars is in large part covered with fluid received material support.

Dr. Müller, of Potsdam, spoke on modern photometric apparatuses, and examined in particular those of Zöllner,

Pickering, and Pritchard, entering into a searching criticism of them. The sources of error of the most considerable systematic deviations in the results obtained with these instruments were not yet sufficiently known, and it would therefore be well to mark out a number of stars of which thorough observations should be taken by the different observers with the use of all the three instruments.

Prof. Seeliger, of Munich, spoke of theoretical, and in part also practical, investigations he had commenced, which for the present had shown that the Lambert law respecting the reflective power of illumined surfaces, the basis hitherto of all photometric experiments, was entirely false. He reserved his more complete exposition of the matter till the close of his labours in this direction.

Prof. Safarik observed that some astronomers to whom he had communicated his "fluorescence plates," whose intermediate junction of eye-piece annulled the secondary spectrum, had given him a favourable report regarding their use. He was always ready, he said, to place other plates at the disposal of any who desired them.

Prof. Weiss announced that he was engaged in the preparation of a catalogue of 4500 stars which had formerly been observed at Geneva, a catalogue which was now approaching its completion.

President Auwers once more expressed thanks for the friendly reception the Association had met with at Geneva and proposed to the meeting that they should rise from their seats in honour of Col. Gautier. The proceedings were then declared to be concluded.

EDUCATION IN THE UNITED STATES

THE pride taken in popular education in the United States makes any digest of their experience valuable; and education, as carried on in their cities, the subject of a recent Circular of Information from the Bureau of Education, is necessarily the branch of it most interesting in our crowded island. Dr. Philbrick, the writer of it, has been, in Boston, a most successful school superintendent, an officer who undertakes the active duties of both School Board and Government Inspector, and one without whose services cities are here said to be behind the times. The uncertainty of a good choice of members for a School Board by popular election in the United States makes this office the more important; women having, as a rule, declined to counteract corrupt votes by their own. Every branch of education is treated upon here. Technical instruction, both as provided in Paris and in the United States, is largely and systematically considered; from the shape it takes in the school, where it simply replaces the gymnasium to boys over thirteen years of age, to the apprentice school which really attempts to supersede the worn-out system from which it gets its name by a more scientific and intelligent teaching of a few trades, among which building in its various branches, necessarily so important in a new country, is always one chosen. School museums are recommended, both of natural history and of technology; the decoration also of schoolrooms with statuary, &c., now provided for the purpose at low prices, a list of which is appended. The rules to be observed in building are a digest of both European and American experience, valuable to every one concerned with the architecture of schools of any class; and we may just note Dr. Philbrick's conclusions—that increased centralisation and permanency are found desirable; that *speaking* French or German is unnecessary to 90 per cent. of secondary scholars; and that high school education is bad for girls. "Free and uniform" is Dr. Philbrick's ideal. He believes that the work of elementary schools can be so revised that the higher subjects will be a simple continuation of the lower; so that a complete elementary course shall be just the same as the first few years of a university education. Higher stages are never to be commenced till after the age of fourteen. Free high schools, "the most truly democratic of all our institutions," are being used by youths who go back to farm work, contending that in no way does a classical education unfit a man for manual labour and attending meetings of "old boys" whose common interest in the school helps to obliterate social distinctions. Such schools are to be provided for the mechanic to carry on his studies therein in the evening; while for higher students manual labour, especially the use of carpenters' tools, is to replace the gymnasium, and be pursued afterwards in evening technical schools;

and thus study and labour will complement each other, and the daily toil of the poor man is raised to the level of the rich man's recreation. Military and fire drill are to be taught, and replace out-door games. We fear that an elementary course complete in itself and different from university rudiments, although perpetuating class distinctions, will probably be a necessary evil for some time yet, and also that paralysis for lack of competition must be incurred where pupils are required to attend the school in their own district of their own city—this necessitating uniformity of books for the sake of families removing.

A PREHISTORIC CEMETERY

A DUNFERMLINE correspondent writes that another cemetery of prehistoric times has been discovered on the estate of Pitreavie. About two and a half miles to the north-east of the former discovery a number of workmen were, some days ago, engaged in collecting rough stones to form an embankment. Ere the work had proceeded far it was noticed that the stones, which lay on a moor, formed a circle, partly covering a mound 200 feet in diameter. In the centre of the mound, and about 36 inches below the surface, a cyst measuring 46 inches in length and 24 inches in width was found. The cyst was three-parts filled with a dark mould, and in it was discovered a beautifully-formed urn which stands 5 inches in height and measures 6 inches across the mouth. There was nothing in the urn but soil, but in the cyst some large calcined bones were found. Explorations were continued in the vicinity of the cyst and within the stone circle, with the result that no fewer than eleven other urns were found. All these urns contained calcined human bones and much vegetable charcoal, both in dust and in pieces, and numerous pieces of burnt bones were also found in the mound—a circumstance which indicates that a good many interments had taken place without urns. The urns measured from 5 to 12 inches in height, are hand-made, and of the type usually known as "food-vessels." They have everted rims, and are ornamented with varied designs, formed by oblique lines and dots on the upper part, and encircling projecting rings at the bulged part. The urns are of a reddish colour, but the pottery section shows a black interior with a mixture of coarse sand. There are several interesting features attached to the discoveries. In the first cemetery a row of cysts with an urn in each were discovered—circumstances which unmistakably indicate the predominance of inhumation over that of cremation. No bones were found in the urns. In the second discovery only one cyst was found, and eleven of the urns were simply buried in the mounds, and all contained burnt bones—facts suggestive of cremation. The second discovery corresponds more than the first with most of the prehistoric local cemeteries which have been laid bare in the county of Fife. The chronological relationship between the two kinds of interment—inhumation and cremation—as presented to us in the two Pitreavie cemeteries, opens up a most interesting field of inquiry to the enthusiastic archæologist. Dr. Worsaae, the late distinguished archæologist, says cremation was the outcome of higher and more advanced religious principles than characterised the people of the Stone Age, who were in the habit of burying their dead in dolmens and other megalithic tombs, with food-vessels, weapons, ornaments, and such articles as were supposed to be serviceable beyond the grave. Founding upon Dr. Worsaae's idea, it is not unreasonable to assume that the two discoveries under notice belong to the Stone and Bronze ages. The urns are all in the hands of the proprietor of the estate, Mr. Beveridge, and are likely to be handed over to the National Society of Antiquaries.

SCIENTIFIC SERIALS

Annalen der Physik und Chemie, No. 8, July 15.—This contains the following:—On the time-relations of the formation of the electric residuum in paraffin, by C. Dieterici.—On the quantity of electrical elementary particles, by E. Budde.—On the theory of thermo-electric forces, by the same.—On a deduction from the laws of electro-dynamic points, suggested by Gauss, by the same.—On some applications of theory of change of form in a body when it is magnetically or dielectrically polarised, by G. Kirchhoff.—Determination of some coefficients of friction and experiments on the influence of magnetisation and electrification on the friction of liquids. The values obtained